Interpreting Technology-Mediated Identity: Perception of Social Intention and Meaning in Bluetooth Names

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ABSTRACT
The ubiquitous and highly personal nature of mobile devices, together with the partially embodied nature of Bluetooth, means that mobile device based Bluetooth provides unique affordances for communicating aspects of identity. We report a study of how people interpret Bluetooth names in terms of social identity, considering it as an example of mobile technology-mediated identity. We used card-sorting, hierarchical cluster analysis, multi-dimensional scaling and qualitative analysis to establish perceived types of Bluetooth name and dimensions of naming; illustrating how people conceptualise and interpret technology-mediated identity projected by others.

Author Keywords
Digital Identity, Social Identity, Bluetooth.

ACM Classification Keywords
H.5.m Information Interfaces and Presentation: Miscellaneous.

INTRODUCTION

The disembodied nature of online interaction, and its rich source of banal communication, has meant that computer mediated communication and online social interactions have been widely studied in relation to the construction of personal and social identity (e.g. Gergen, 2002; Turkle, 1995). However, other forms of digital communication, notably telephony's transition from fixed "land-lines" to mobile wireless phones, have also had great socio-technological impact on our lives (Castells et al., 2006; Haddon, 2000; Ling, 2004).

The ubiquitous and mobile nature of such technology allows us to make use of mobile devices wherever we are, serving as a reminder of the individual's connectedness (Ling and Yttri, 2002) and reinforcing a sense of social identity. The mobile phone in this sense is an extension of its owner and may be viewed as an *embodied* technology. Thus the mobile phone can act as an interaction object (i.e. can be appropriated as a tool or "prop" in social interaction) to afford implicit communication with those co-present as well as providing channels for explicit communication with those remotely located. Yet, as Ling and Pedersen (2005) point out, psychological and linguistic aspects of mobile telephony have not been completely developed, particularly in relation to the mobile phone's non-voice uses. *Physical* use of mobile phones as interaction objects in constructing identity has been documented; e.g. as personal objects they can act as status and fashion symbols (Katz and Sugiyama, 2005; Satchell, 2003). But how users appropriate and utilize the *digital* affordances of mobile technology (e.g. voice calls, text and picture messaging, and data transfers) in communicating and constructing identity has mainly been addressed with respect to remote communication (see Goggin, 2006, for a comprehensive review of the area) and is relatively unexplored in other respects.

SOCIAL IDENTITY AND MOBILE TECHNOLOGIES

Social Identity

"Identity" encapsulates the essence of a given object or being. When referring to people, identity inevitably involves embodied activity (Budgeon, 2003) and thus interaction between physical and social-psychological factors. Identity, rather than being a relatively fixed and static entity within the individual, is ascribed according to our own and others' discourse (Gergen, 2002). This in turn shapes how we view the world and ourselves (Burr, 2003). Social identity thus involves *perception* and *interpretation*, as well as *projection*. Identity (and associated values and meanings) is dynamically constructed through the communication and discourse of social interaction and maintained through relationships and social networks (De Fina et al., 2006; Thoits and Virshup, 1997).

Technologically Mediated Identity

Computer mediated communication and "online identity" have been widely discussed (e.g. Bargh and McKenna, 2004; Turkle, 1995). However, technologically mediated identity is perhaps most salient in relation to mobile technologies. Mobile devices, most evidently mobile phones, have become pervasive and are arguably changing the rhythm of urban society (Haddon, 2000). They enable *ad hoc* contact, enabling roles and contexts to intrude upon other situations, challenging social norms to evolve in new ways to cope with such "interruptions" and "inappropriate use" (Fortunati, 2005; Ling, 2004; Strassoldo, 2005). The mobile phone has become intrinsically linked to our everyday lives, both physically and socio-functionally. Mobile phones are

an important mechanism for creating and maintaining social networks (Satchell, 2003), and thus identities. They have taken a step beyond enabling the "presence of absence" by providing a reminder of another person (Gergen, 2002; Licoppe, 2004); they enable the relatively novel possibility of being reachable almost anywhere by anyone at any time. This pervasiveness is possible because of the mobility of the devices but they are not just portable – they are *personal*. We no longer contact the location; instead we contact the *person* (Ling, 2004). The device, in this sense, is an extension of its owner and serves as a reminder of the individual's connectedness (Ling and Yttri, 2002), reinforcing a sense of social identity.

Owning a particular phone may *implicitly* communicate identity discourses and group affiliations (Fortunati, 2005), e.g. wealthy businessperson, interested in technology, etc. As well as enabling such discourses associated with the device as a personal object (Csikszentmihalyi and Rochberg-Halton, 1981; Dittmar, 1992), mobile phones also enable *explicit* communication: voice calls, text messages and, our focus here, Bluetooth transmissions.

Bluetooth and Identity

The Bluetooth protocol allows the user to give each device a "name". A device will broadcast this "digital identity" so long as its Bluetooth is switched on and is set to be discoverable. When a person with such a device moves into the range of a Bluetooth sensor, such as another Bluetooth enabled phone, her presence can be sensed and this digital identity can be communicated.

The close coupling of mobile phone and owner means that a Bluetooth name becomes a pseudonym used in contacting the individual; representing *the person* rather than just her device (Kindberg and Jones, 2007). Thus, the customised Bluetooth name becomes a mode by which the individual communicates her "digital social identity". It enables the device to be identifiable to in-group members as belonging to its owner, without it becoming obvious to others who this is; in this way, *social* identity is communicated and reinforced.

Identity mediation by pseudonyms is not limited to Bluetooth (and occurs both in the physical world and online) and has been discussed in relation to online identity mediation, for example in terms of newsgroups (Donath, 1999) and email addresses (Heisler, 2006). Similarly to these online contexts, to outsiders, beyond the in-group, it may not be apparent to whom a given Bluetooth name belongs. Unlike online interactions, however, the Bluetooth protocol dictates that Bluetooth-based interactions occur in relative physical proximity but it may not be apparent to whom a given Bluetooth name belongs even if the owner is close by. Thus, Bluetooth interactions lie somewhere between wholly embodied face-to-face interactions and the disembodied medium of Internet exchanges between remote strangers. Users appropriate the way in which Bluetooth operates as a "partially embodied" medium to project their digital identity while retaining a level of anonymity, making it a unique paradigm of socially and physically embedded communication (Kindberg and Jones, 2007). This partially embodied nature of Bluetooth communication calls into question how people interpret the digitally mediated identity projected by others in the form of their Bluetooth names.

INTERPRETING PROJECTED IDENTITY

Categorising Bluetooth Names

Between 2005 and 2009 approximately 12 static Bluetooth sensors operated within the City of Bath (see O'Neill et al., 2006). Each sensor continuously searched for discoverable Bluetooth devices (those with Bluetooth switched to "on" and "discoverable" and passing within range of the sensor), recording the device's unique Bluetooth ID (often referred to as MAC address) and customizable Bluetooth name. While these names may be *chosen and projected* for a variety of reasons from illicit to benevolent (Friedman and Resnick, 2001; McCarthy, 2007), the study reported here uses the resulting dataset of over 35,000 unique Bluetooth names to investigate how people *conceptualise and interpret* Bluetooth names, as an instance of technologically mediated social identity.

We recruited 50 participants from a combination of members of the public selected to represent a wide demographic range and a general opportunity sample. An open card-sort methodology was used to uncover mental models of Bluetooth name interpretation since the method enabled participants to categorise names, and attribute labels and descriptions to these categories as they considered appropriate (Hinkle, 2008).

Initial Card-Sorting Activities

Five separate sets of 50 randomly selected unique Bluetooth names were created from the original dataset. Each participant then independently sorted one of these five sets (so that each set was independently sorted by an equal number of people in each study). Two independent studies were then conducted using the same card-sorting methodology (and sets of names) but different sorting criteria. The first study asked 25 participants to sort the Bluetooth names into groups according to any criteria of similarity that they deemed appropriate. The second study asked the remaining 25 participants to sort the names into groups they regarded as similar in terms of social identity, i.e. "similarity of the people the name belongs to or describes". The first sorting exercise provided a general mental model of Bluetooth names, whereas the second explicitly addressed social identity as expressed though the Bluetooth names. Thus, it was possible to compare the social identity groupings with the general groupings in order to indicate how explicit or implicit social identity is in the *interpretation* – rather than generation and projection – of Bluetooth names.

We used multivariate hierarchical cluster analysis (MHCA) to analyse the Bluetooth name categorisations. This method indicated how participants viewed the names as similar by showing how many participants

grouped each name together (i.e. the frequency with which each name occurs with each other name), thereby providing meta-categories of Bluetooth names.

A relatively clear cut-off point between the resulting meta-categories of Bluetooth names could be observed from the card-sorting results. These distinctions became particularly evident when participants' rationales for their groupings were also considered, providing qualitative support and a level of contextual understanding to these meta-categories.

Type of Name	Sub-Type of Name		Description
Device Names	Default Model		Default device model numbers / randomly chosen, or at least hidden meaning. Indescript people who do not want to be noticed.
	Person's Ownership		Identify themselves through association with something (likely to be a device), almost boastful about ownership/association.
People's "Real" Names	Full/Formal Name (or fist name with initial), No Embellishment		Full/formal name (or first name with an initial) with no embellishment. Average, ordinary people.
	First Name		"Normal", "stable" people with no reason to hide/want to be recognised and are happy for people to know it is them. Likely to be serious with less imagination.
Nicknames	Based on "Real" Name	Abbreviation of "Real", Formal Name	Not really trying to stand-out, doesn't say much about their personality or interests etc., but make a little effort to identify themselves by adding an initial etc. or by making it more playful. Gregarious, fun people.
		Symbols Added / Spelt with Symbols	As with "First Name" group, but embellishments are just to make the names recognisable as being unique (i.e. could be quite a common name), or possibly to draw attention to it. Interpreted as playful in manner. But often confuses people as to the meaning (interpreted as "random"). Likely to be quite a young person, perceived as most likely to be female.
		Name Contained within Phrase	Likely to be a nickname made-up/used by others, based on the person's name. The person is likely to be trying to be creative/funny, or brag. They are happy to broadcast nicknames that describe something of themselves/how they wish to be seen by others. Often interpreted as playful. But the name isn't always perceived as revealing much about them as a person.
	Descriptive	Pet Names	Nicknames used in "real-life" by others.
		Alias'	Nicknames made-up by the person, usually likened to online context. Not actually called this by anyone but anonymously reveals something of the person - they want to tell people this is what they are like/they are wish to be "mysterious but unique". Likened to a username. Likely to be concerned with privacy, but light-hearted, fun, friendly people as possibly trying to be funny/brag (but sometimes self-deprecating).
Dynamic Messages	Attention Seeking / Declarative Messages		Likely to include email address to reflect their awareness others may want to contact them/encourage contact in this way. Trying to communicate without necessarily revealing themselves overtly.
	Expressive Statements		Saying something about how they feel, or expressing an opinion, rather than necessarily identifying or describing themselves. Possibly also to reflect how they would like to be seen, but is likely to come across as "random." Not obvious who or what the name is communicating, but it appears to communicate a message to the reader to provoke a response.

Table 1. "Types" of Bluetooth name established from the *Initial Card-Sorting Activities*.

Findings

The labels provided for each grouping provide us with an understanding of how the participants conceptualised the names as similar. These group labels formed the titles of the emergent meta-categories of Bluetooth names through assessing the frequency with which each group label was attributed to each name, and therefore each category of names. Thus, we were able to gain some understanding of *how* participants conceptualised the names as similar. Similarities between the meta-category titles were used to collapse them to form a summary of *types* of Bluetooth name (Table 1).

Several themes emerged when addressing the types of names and associated interpretations. The perceived "tone" in which names were written was often used to characterise the type of person behind the name. For example, names regarded as fun, playful, jokey, serious, threatening etc were often attributed as belonging to people possessing corresponding personality traits, or wishing to be perceived as such. This interpretation was often extrapolated to offer additional inferred detail about the "character" of the name's owner.

Anonymity and the degree to which the name revealed a "real" name or information about the person's "character" were repeatedly mentioned. Participants often distinguished between a nickname that they perceived the owner was called in "real life" and was likely to have been *attributed to* her, and names that were likely to have been *made-up by* the owner. The latter were often regarded as being for use in contexts where anonymity was expected or valued, such as online chat rooms. Participants also suggested that users making up their own pseudonyms were likely to be doing so specifically to project a particular "image" of themselves. Participants often placed the names within a context where this kind of name would be "appropriate for its imagined owner", meeting expected norms of anonymity, tone etc. The denotation of ownership/belonging and the context within which a name would be used were often referred to as factors in making social identity-related judgements. Some participants explicitly suggested that when some users chose to use a "real nickname" they were referencing a shared group experience and/or projecting an identity by which they had become known within a specific in-group. Therefore, by using this as their Bluetooth name, they are reinforcing their ties to this social group while remaining anonymous to others.

Comparing the Initial Card-Sorting Activities' Data

Bluetooth names were interpreted similarly in both initial studies, producing similar labels during categorisation. However, the *rationales* given for labels varied between the studies. The social identity based card-sort, unsurprisingly, elicited more *explanation* in terms of the kinds of people who participants perceived would use such a name and the reasons why they might do so, i.e. information regarding the social identities projected through these names. However, the similarity of interpretation across both card-sorts indicates that social identity was a salient factor when considering names in situations where the owner of the name is not present to provide further information regarding its actual meaning, as is often the case with technologically mediated information and Bluetooth in particular.

Follow-Up Card-Sorting Activity

During the initial card-sorting activities, participants were asked to rate each name as to how well it fitted within the group in which they placed it. Using this information, we extracted the 50 names rated as best exemplifying the categories in which they were placed. These 50 names then constituted a new set of cards that could be sorted. The findings from this activity then served to validate and expand the findings of the initial card-sorting activities. Participants were asked to sort the 50 top rated Bluetooth names according to social identity, i.e. the perceived similarity of the *people* each name represents or belongs to. We requested that they think aloud as they sorted, explaining their thinking about their grouping decisions and how they viewed each name and the person behind it.

An MHCA was conducted to indicate how the names were interpreted and if this was similar to the initial card-sort. Figure 1 illustrates how the participants grouped the people represented by the names. The dendrogram shown in Figure 1 depicts a hierarchical linkage of the names. The more participants who placed particular names together in a group, the lower the distance score on the dendrogram. Cut-off points between the groups were fairly evident when considering the names, and were clarified when participants' labels and descriptions of their groups of names were also considered. When participants' labels and descriptions are taken into account, the meta-categories of names depicted next to the dendrogram (in Figure 1) emerge. The group labels formed the titles of these emergent meta-categories through assessing the frequency with which each group label was attributed to each name and, thus, category of names.

As was observed in the previous card-sorting exercises, subtleties of judgment about the people to whom the names belonged varied between participants, however, names were interpreted according to very similar criteria. This similarity extends between the card-sorting exercises as well as between participants in each exercise, suggesting that people interpret Bluetooth names consistently and that these names are indeed perceived as representing particular kinds of people.

Multi-dimensional scaling was also conducted as this allows the generation of dimensions of similarity. Labels for the dimensions were established through qualitatively analysing the group labels and descriptions attributed to each card in relation to where it sat on these dimensions. This analysis provided a plot illustrating how the names are grouped as similar across all participants. Each meta-group of names is depicted by a cluster plotted in relation to dimensions of similarity (Figure 2).

Meta-Category	Bluetooth Name
"Real" Name ▪ *Broadcasting identity/presence* ▪ *Not concerned with privacy*	Dave mills Andrea Innes Alex Evans Derrick Alessandro Andreia
Nickname	Gess Gamms
Embellished Name ▪ *Friendly, Social, Playful* ▪ *Broadcasting, Aware of visibility to others* ▪ *Young*	.x.chloe.x. ∞~jackie~∞ *Miss jefferies* ;-)Ian;-) Fran√ßois ... Becci … ~*He@thÄr*~
Name + Device Type ▪ *Denote ownership/* ▪ *Identify device* ▪ *Functional*	Brian mobile AndyMobile Andrees phone Ashwin macbook Caetano Altafins Computer
Device Default (+Name)/Service ▪ *Lazy/Evasive*	Caths SGH-Z400V Catrin- S700i Cony-N95 8G Active print N80 AKB-900
"Code" ▪ *Purposely Evasive/ Mysterious/Cryptic*	??©©? (*$kr!$t!@n$*) (X)-G3mZ!-(X)
Cryptic (in-group) Message	¬§THANKS¬§ 10U15
Unidentifiable	(unknown)
Service/Company	Adversitas frontera
"Blokey" ▪ *Showing-off, Broadcasting* ▪ *Crude humour* ▪ *Expresses a statement/message*	Nobby! Big pete (i mean big Boyo big balls Fuck my face! Get ur mits off Breasts Arsenal Suck
Descriptive Made-Up Nicknames ▪ *Broadcasting*	Get Away From the Dylan Garlic bread Captain B big.bird Dozey denny *super star dj* *.*.Honey.*.* Blindy G_R_1_F_F_0
Cryptic Screen-name ▪ *Based on interest /team allegiance*	Aresen3l

Dendrogram

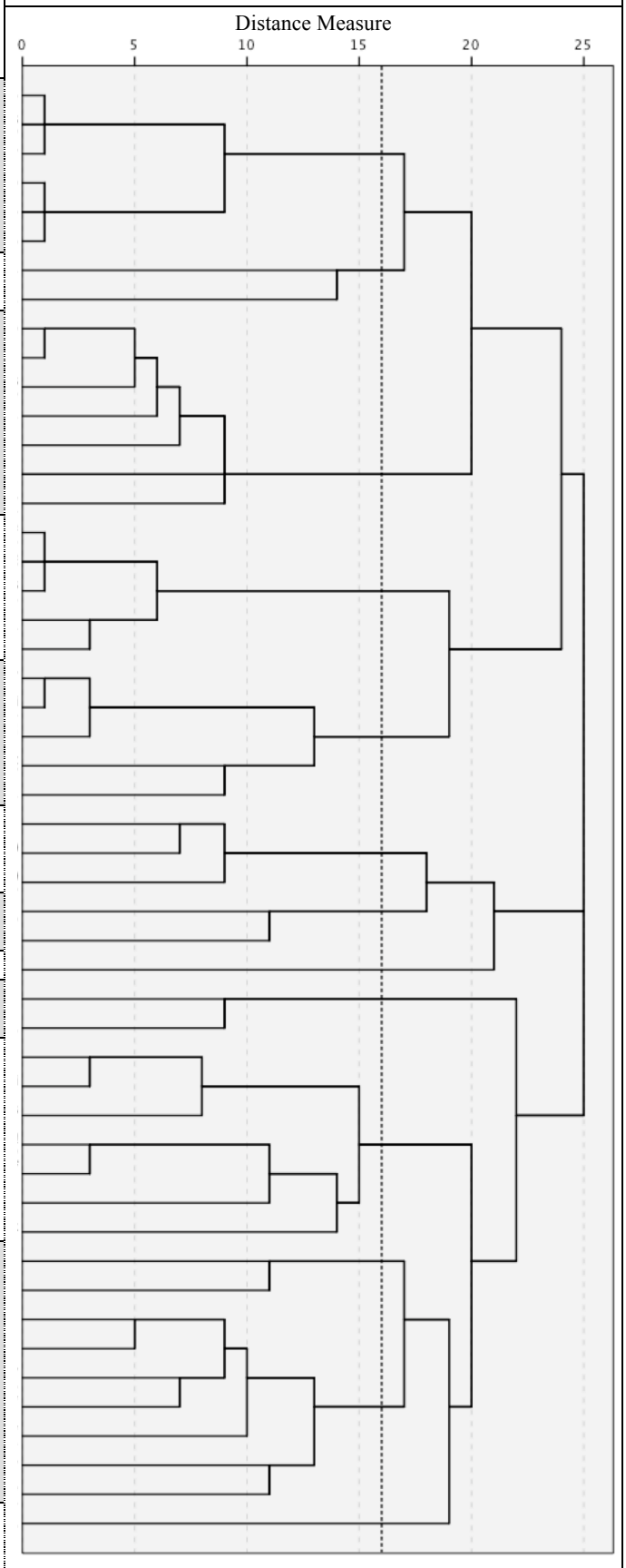

Figure 1. Dendrogram illustrating *Follow-Up Card-Sorting Activity* participants' grouping of Bluetooth names with meta-category descriptions of how the names were perceived as similar.

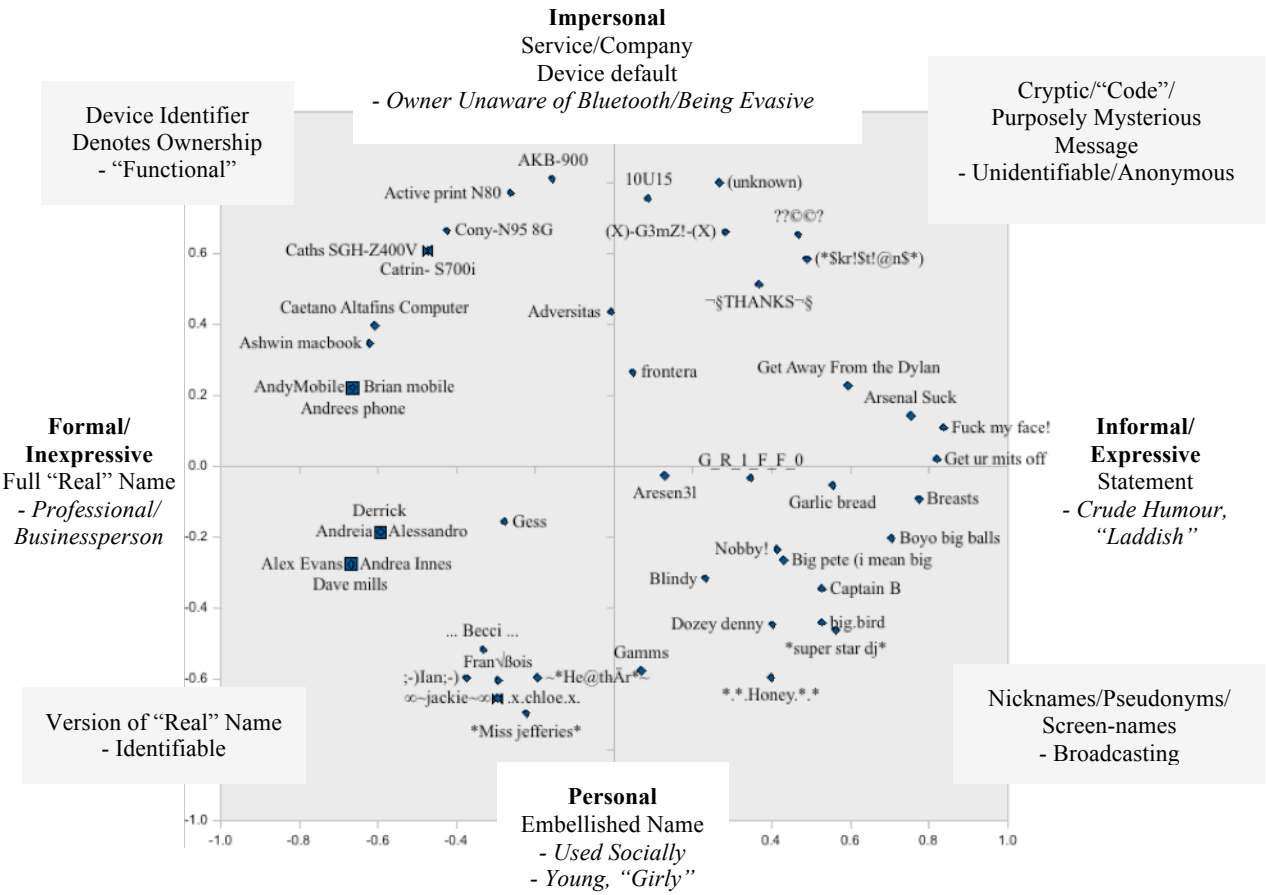

Figure 2. Graphical plot of *Follow-Up Card Sorting Activity* participants' interpretation of Bluetooth names.

These dimensions reflect the themes established from the initial card-sorting activities, validating and refining these findings. By analysing participants' descriptions and labels in terms of the graph dimensions we can formalise and clarify the themes.

Findings

The group labels and "think aloud" descriptions were analysed qualitatively to provide an understanding of how the participants perceived the names as similar.

Participants distinguished between names that were interpreted as identifying the individual to whom it belonged, denoting device ownership, and expressing something about the owner or a message. Several themes similar to those in the initial card-sorting activities emerged from participants' interpretations in distinguishing these meta-categories of names.

Again, the perceived "tone" in which names were written was often used to characterise the type of person behind the name; often being attributed to people possessing corresponding personality traits or wishing to be perceived as such. However, this was often discussed in relation to the context in which the name's owner was perceived to use Bluetooth; e.g. socially, for "functional" purposes, or just being unaware of Bluetooth altogether. Anonymity, and the degree to which the name revealed a "real" name or information about the person's "character", was also repeatedly mentioned, as in the initial card-sorting exercise. However, this was discussed in relation to the name owner's privacy concerns/wish to broadcast their identity and, again, their perceived use of Bluetooth. Full "real" names were attributed to more mature professional or business people. They were perceived as unconcerned about privacy and using Bluetooth for more "functional" (rather than social) purposes in a more formal setting such as work.

Names such as *frontera*, *Adversitas* and *ActiveprintN80* were considered to represent a non-human entity, such as a company or service. Participants often attributed this to the appearance of having been customised from a default name but not revealing anything about a person – either in terms of their name or self expression of any kind. Such names were interpreted as having meaning, albeit unclear and impersonal meaning.

Names with numerical characters were also sometimes perceived as cryptic/coded, perhaps a naming convention as part of a wider system, or more commonly as default device names belonging to people who were unaware of or uninterested in Bluetooth. Those with "real" names that prefixed a perceived default were interpreted as belonging to people who were "lazy" as they had altered their Bluetooth name, exhibiting some awareness of the technology, but had only partially done so as the default was still included. However, they were interpreted similarly to those names that used a "real" name and the kind of device (e.g. *AndyMobile*) as being used for "functional"

purposes to distinguish the device from others and as belonging to its owner, who might have more than one Bluetooth device.

Participants often struggled to read names using "embellished" characters to replace letters, frequently interpreting them as like names found in an online context (e.g. sign-in names or "hacker-type" aliases), and likely to be used across digital contexts. Those using *additional* characters as embellishment were perceived as revealing their real name but making it seem more "friendly"; in contrast to the online context names whose owners were often interpreted as elusive or cryptic. Participants interpreted embellished names as indicating a high awareness of the technology; which was perceived as more likely in younger users. Participants also commonly discussed how the owners of these names had taken time and effort consciously to create a particular "image" of themselves to project, and this was the "kind of thing" younger users would be more concerned with.

Bluetooth names that were interpreted as unrelated to the owner's real name or device, but were in some way descriptive or expressive, were generally interpreted as made-up nicknames. These were often described as purposely broadcasting a given characteristic or interest relating to the owner, rather than directly identifying the person. These were sometimes likened to aliases that would be encountered in other situations, e.g. as online sign-in names. They were perceived as social, since the naming style was informal, but potentially wary of privacy issues as they did not reveal a real name.

Bluetooth names perceived as expressive statements or messages were often interpreted as crude, provocative and/or attempts at puerile humour. They were seen as "laddish" and participants frequently described the names' owners in these terms. The names were interpreted as less revealing information about the owner (either in terms of actual identity or interests) and more focused on the act of broadcasting a message. Despite perceiving these names in anti-social/aggressive terms, participants considered their owners as using Bluetooth in social rather than purely functional ways.

CONCLUSION

Participants exhibited an awareness of the potential that Bluetooth names have as a medium for communicating social identity. Further, they interpreted the names in these terms and perceived that others use them as a medium for communicating in this way. While interpretation of the kinds of people represented by Bluetooth names is likely to vary between individuals based on subjective schemata, our results illustrate that factors likely to lead people to make such identity related judgments are essentially similar.

Bluetooth names were interpreted as representing the person rather than just her device. Participants distinguished between names perceived as revealing the owner's actual identity and those that expressed something more personal about the owner without necessarily directly revealing who it was; similarly to Heisler and Crabill's (2006) findings about "expressive" email addresses.

More personally expressive names were perceived as intentionally "broadcasting" social identity relevant discourses. Their owners were perceived as sociable people, as identity is dynamically constructed through communication and discourse within social interaction and maintained through relationships and social networks (De Fina et al., 2006; Thoits and Virshup, 1997). More explicit digital social identity (i.e. names perceived as more explicitly communicating given discourses) was interpreted as representing more socially motivated people. Furthermore, these findings suggest that the disclosure of elements of non-digital identity, augmenting digital data with "clues to what the person is like in real life" does indeed add meaning within digital interactions (Satchell, 2006, p.11) – and that this is not only the case in online situations.

As well as impressions being "context *driven*" (Heisler and Crabill, 2006), our findings suggest that information on the context and style of use of the technology is *sought* (participants looked for cues in the names relating to this), in order to make judgements about the people whom the names represented. The personal experiences and situations used to explain the interpretations varied from face-to-face to online, and from those where someone's "real" identity is known to situations where a more cryptic or expressive pseudonym is the norm. By calling upon experience in other situations as well as those directly relating to Bluetooth, participants were able to relate this medium to identity communication across a range of contexts.

Participants considered this Bluetooth mediated context as an instance of digitally-mediated identity communication. They considered such communication as intrinsically linked to the context of use and motivations of the user, reflecting the socio-functional appropriation of Bluetooth as a partially embodied medium. This technology-mediated identity was viewed as very much grounded in "real life", in contrast to more traditional views of online identity as not only disembodied but parallel to real life (Turkle, 1995).

The digital affordances of this mobile technology have been appropriated, as well as the devices themselves (Fortunati, 2005), in communicating and constructing identities – and are perceived as enabling this appropriation. Although individual interpretations may vary, the information sought in order to interpret and construct technology-mediated identity in this way is remarkably consistent. Thus, mobile technologies have enabled users to appropriate a partially embodied communication medium such as Bluetooth to dynamically construct grounded social identities.

We are moving towards an understanding of everyday "cell phone culture" (Goggin 2006) and are beginning to develop an understanding of such interactions from a more psychological perspective also. This research contributes to this understanding through exploring how people interpret Bluetooth names in terms of social

identity, considering this as an example of mobile technology-mediated identity distinct from previously explored examples of the use of the mobile phone in remote communication or as an interaction object.

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